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Chloramine: The Right Choice to Protect Public Health

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In the mid 1800's John Snow removed the handle from a water pump in a London neighborhood, and in so doing put a stop to an outbreak of cholera that had killed more than 500 people in a 10 day period. One hundred and fifty years later, much progress has been made in understanding and preventing the transmission of waterborne diseases. Public drinking water providers now know to protect water supplies at the source and to use disinfectants to prevent growth of dangerous bacteria in the water distribution system. The maintenance of what is called a "residual" of disinfectant that stays in the water distribution system while it is delivered to peoples' homes is not just good public health practice; it's required by the Environmental Protection Agency (EPA).

The EPA regulations give two choices for disinfectant residual—chlorine or chloramine. The primary reason so many major water agencies in the Bay Area and throughout the nation are changing to chloramine is to consistently meet current and anticipated federal drinking water regulations and to protect the public health. One of the principal benefits of chloramine is that its use reduces the overall levels of certain regulated contaminants compared to chlorine. The San Francisco Public Utilities Commission (SFPUC), in deciding to implement a switch to chloramine for residual disinfection, considered the available evidence and weighed the risks and benefits of each option against the other.

There are many similarities between chlorine and chloramine. Both provide effective residual disinfection with minimal risk to public health. Both are toxic to fish and reptiles (chlorine or chloramine comes in direct contact with their bloodstream through their gills) and must be removed from water added to aquariums and fish ponds. Both must be removed from water prior to use in dialysis machines, since water comes into direct contact with the bloodstream during treatment. When drinking water, people have no trouble digesting chlorine or chloramine at the levels found in our drinking water; this water is not introduced directly into the bloodstream. A comprehensive search of the medical literature does not reveal any studies showing that people with compromised immune systems, weak livers or those who are taking drugs have any special problems metabolizing chloramine.

Like chlorine, chloramine is not new. The San Francisco Public Utilities Commission (SFPUC) was the last large water agency in the Bay Area to convert from chlorine to chloramine disinfection when it did so in February 2004. East Bay Municipal Utilities District, Marin Municipal Water District, Contra Costa Water

District, Alameda County Water District and Santa Clara Valley Water District all changed to chloramine disinfection over the last decades. Chloramine has been used extensively around the world since the 1930's, and approximately one-third of all U.S. water systems now use chloramine for residual disinfection.

Both chlorine and chloramine react with other compounds in the water to form what are called "disinfection byproducts". Herein lies the crucial difference that makes it clear why chloramine is a better choice: chlorine forms many disinfection byproducts, including trihalomethanes (THM's), haloacetic acids (HAA's), and N-nitrosodimethylamine (NDMA), whereas chloramine forms a significantly lower amount of THM's and HAA's, even though it may still form small amounts of NDMA. In the weighing of risks and benefits, this is an important benefit that tips the balance to favor chloramine.

Much of the discussion about chloramine has focused on NDMA, and it is critical to distinguish between chloramine and NDMA. NDMA can be a byproduct of chloramination or chlorination, but drinking water is not a major source of exposure to NDMA. The biggest sources of human exposure to NDMA are tobacco smoke, chewing tobacco, bacon and other cured meats, beer, fish, cheese, toiletries, shampoos, cleansers, interior air of cars, and household pesticides. In addition, NDMA can form in the stomach during digestion of foods or drugs that contain alkylamines, which are naturally occurring compounds.

At very high levels--100,000 times greater than even the highest levels seen in a recent survey of chlorinated and chloraminated drinking waters--NDMA may cause serious human health problems like liver disease. Such effects are seen at concentrations ranging from 5 to 50 parts per million in water; for comparison a study conducted by the California Department of Health Services in 1999 and 2000 found the highest level of NDMA in drinking water that had been treated with chloramine was 0.00006 parts per million. In that study, most of the concentrations of NDMA were far lower than that, and many water samples in the California Department of Health Services study, including those from the SFPUC water system taken in 2000, did not have any detectable concentrations of NDMA at all. The SFPUC is going to continue to monitor for NDMA now that the switch to chloramine has been completed, and it is not anticipated that high levels will be observed, given the very high quality water source and treatment practices.

In making any decision, the known and unknown risks need to be balanced with the known benefits. It is clear that in switching from chlorine to chloramine the SFPUC carefully weighed the choices and picked the best disinfectant given the most current information available.

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